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US Army Research Laboratory

Determination of Altitude Sickness Risk (DASR) User's Guide for Apple Mobile Devices

by David Sauter and Yasmina Raby

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14. ABSTRACT
Working in high-altitude environments can adversely impact Soldier effectiveness and result in serious health effects—or even death. This report describes an easy to use mobile application that can be used to provide guidance on these effects.

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1. Introduction

The Determination of Altitude Sickness Risk (DASR) application (from here on also referred to as the "app") provides guidance regarding impacts to physical work performance and cognitive performance as well as the risk of altitude illness as a function of environmental, mission, and individual factors. Output is based directly on information in Table 3-2 of the "Altitude Acclimatization and Illness Management" Technical Bulletin (TB).[1] DASR runs on Apple iOS (mobile operating system) and Android-based smart phones and tablets (referred to from here on as the "devices").

DASR was hosted on the devices to address the issue of altitude illness in the military. Availability on a mobile device ensures that critical high altitude illness guidance is readily available at lower echelons and/or remote locations where laptop or desktop computing platforms and/or network connections back to a higher echelon (from which altitude related information would likely be disseminated) are not available. For a more detailed discussion of mobile device relevance to the military see, "Android Smartphone Relevance to Military Weather Applications".[2]

2. DASR Inputs

To launch DASR, simply tap the DASR icon on the device start screen (Fig. 1). The initial input screen is then displayed for the user to enter the environmental factors information (Fig. 2).

DASR is a multiview (a view refers to an individual graphical user interface [GUI] screen) application with a tab bar (see bottom portion of Fig. 2). The user enters the required inputs (default or previously entered values are prefilled) by tabbing through the various views and selecting the fields that he wishes to modify. Numeric inputs are checked for appropriate values and are restored to the initial value if out of range or invalid (e.g., a non-numeric character). Upon DASR exit, valid input values are saved (via data persistence) for auto-filling of entry fields the next time the app is run. Text field inputs (altitude and temperature fields), labels ("Steep, Rugged Terrain?"), toggle-switches ("Carbon Monoxide Heaters?" entry) and "Segmented Controls" (a widget used to select the "Work Rate:" choice in Fig. 3) GUI elements are all used in the DASR app.

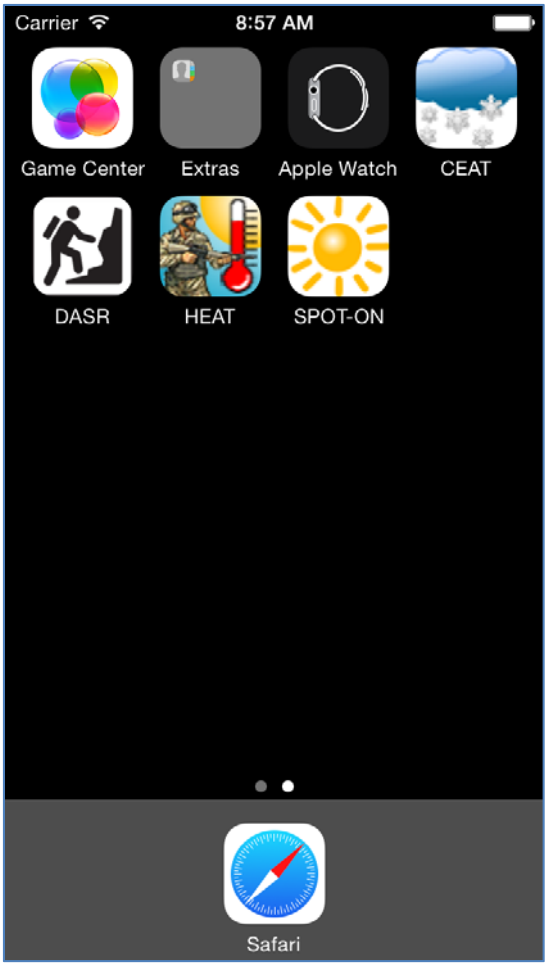

Fig. 1 Launch DASR

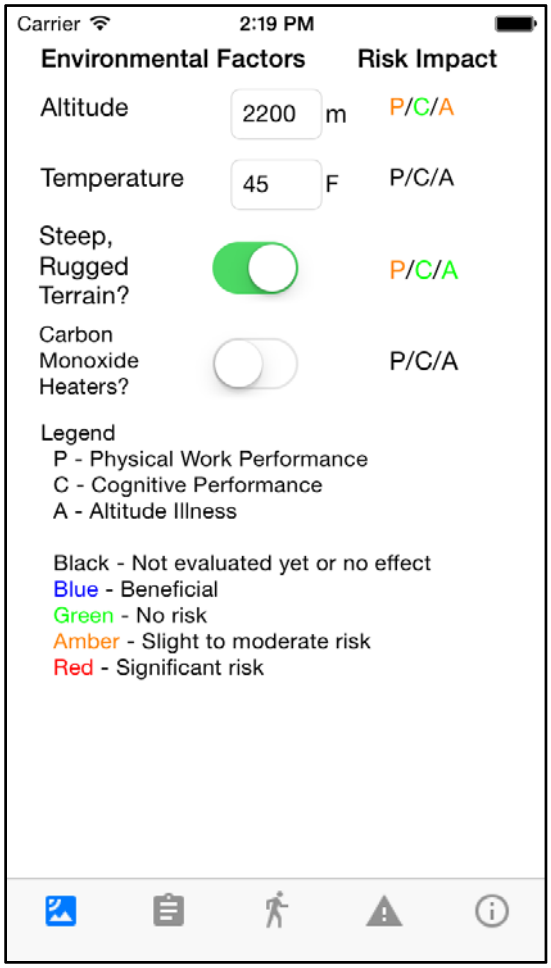

Fig. 2 Environmental Factors view

If a Global Positioning System (GPS) capability is present with the device, the altitude value could be automatically retrieved and displayed as the default in the Environmental Factors view altitude text field box.

Upon valid entry of the each input, Physical Work Performance ("P"), Cognitive Performance ("C"), and Altitude Illness ("A") risk values will be determined and displayed accordingly as color-keyed indicators under the "RISK IMPACT" column on the right side of the view. The color coding key is displayed at the bottom of the view and is valid for subsequent views as well. Thus, in the Fig. 2 example, for the "Altitude" environmental parameter, there is a "Slight to moderate risk" for physical work performance and altitude illness while there is "No risk" for cognitive performance.

The next view in the sequence of tabs allows the user to enter the mission factors (Fig. 3) affecting the performance impacts and the altitude illness risk. Again, color

coding is the same as for the environmental factors. Note, that in this example, there are significant risk (red) physical, cognitive, and altitude illness impacts due to the "Ascent Rate Above 2400 m" value being greater than 600 m/day.

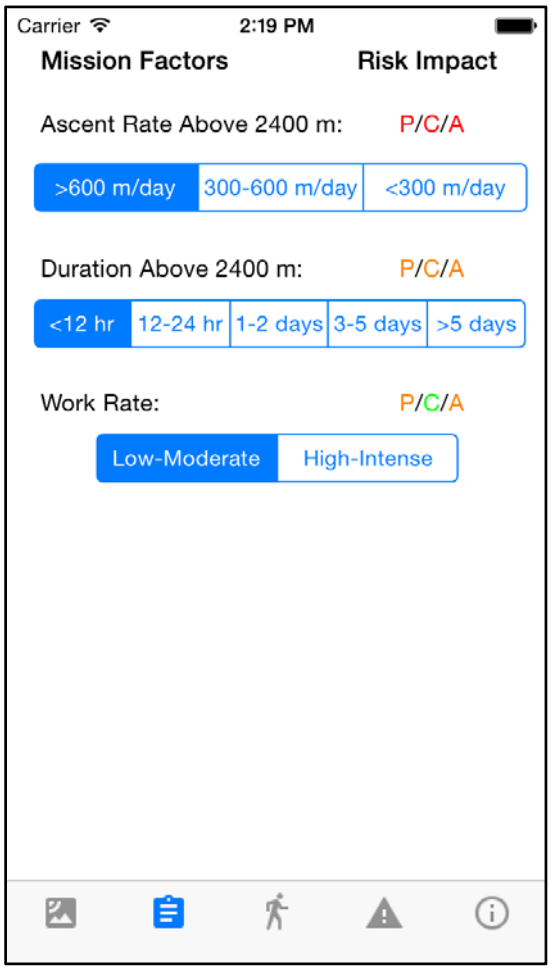

Fig. 3 Mission Factors view

Figure 4 is a screen capture of the individual factors view used to allow entry of those inputs. The "RISK IMPACT" values are once again determined upon entry of the parameters. Risk and impact level determination for the various factors is relatively intuitive (e.g., there are increased performance impacts and a greater altitude illness risk due to sleep deprivation). TB MED 505 should be consulted for additional details if necessary.

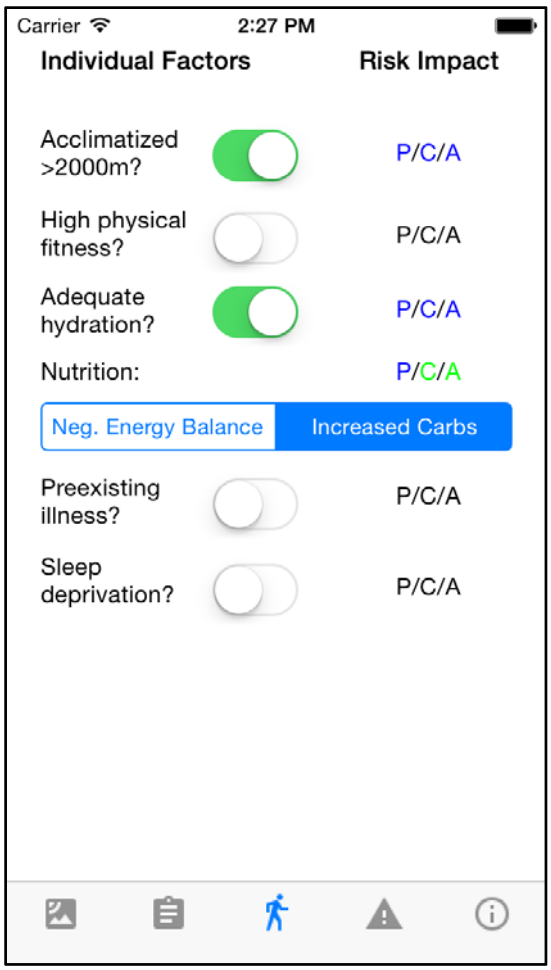

Fig. 4 Individual Factors view

The risk view (Fig. 5) tabulates and displays the cumulative physical work performance, cognitive performance, and altitude illness results from the Environmental Factors, Mission Factors, and Individual Factors views. Thus, in Fig. 5, there are a total of 3 beneficial physical work performance impacts, 4 no risk cognitive performance impacts, etc.

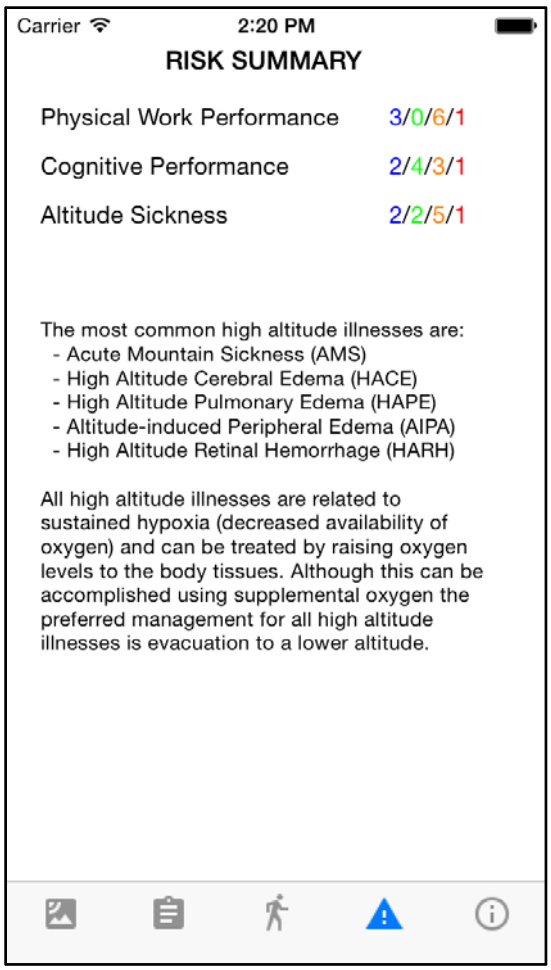

Fig. 5 Risk Summary view

The last view (Fig. 6) simply provides the Point of Contact (POC) information, the version and date of the app.

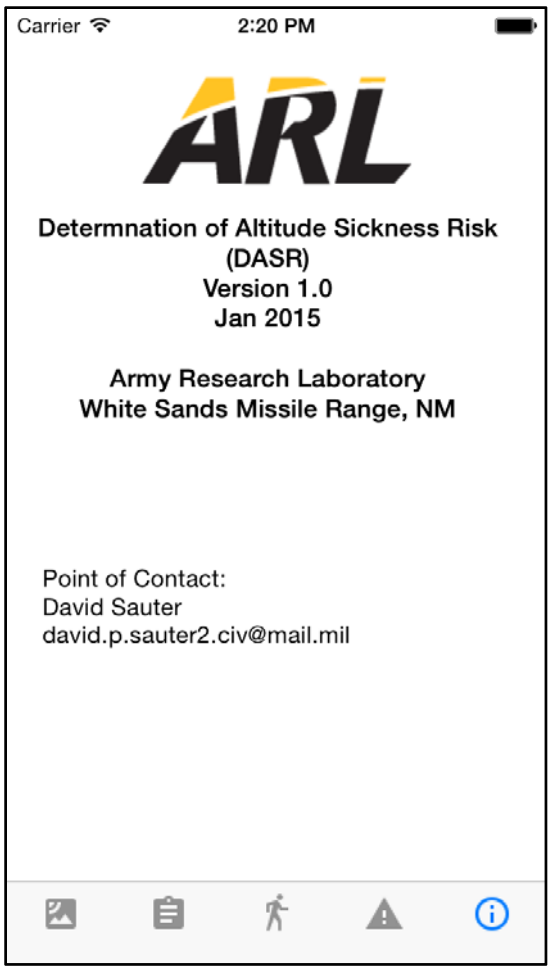

Fig. 6 Information view

3. Summary and Conclusions

DASR provides easy to use and readily understood guidance regarding physical performance and cognitive performance impacts as well as the risk of altitude illness to Soldiers. Hosting on a mobile device should make it accessible virtually anywhere in a tactical or training environment.

Final internal testing and evaluation of DASR is anticipated in 2015. It will then be transitioned to the Defense Information Systems Agency's (DISA) Mobile Application Store (MAS). Via the MAS, Department of Defense individuals will be allowed access to the DASR app for their use.

4. References and Notes

1. Department of the Army, Headquarters. Altitude acclimatization and illness management. Technical Bulletin Medical 505, 2010. [Available online at http://armypubs.army.mil/med/index.html].

2. Sauter, D. Android smartphone relevance to military weather applications. White Sands Missile Range (NM); Army Research Laboratory (US); 2011. Report No.: ARL-TR-5793.

List of Symbols, Abbreviations, and Acronyms

“A”	Altitude Illness
app	application
ARL	US Army Research Laboratory
“C”	Cognitive Performance
DASR	Determination of Altitude Sickness Risk
DISA	Defense Information Systems Agency
GPS	Global Positioning System
GUI	graphical user interface
MAS	Mobile Application Store
“P”	Physical Work Performance
POC	Point of Contact
TB	Technical Bulletin

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